Calculus 1 Workbook

Optimization

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MATH

CRITICAL POINTS

■ 1. Identify the critical point(s) of the function on the interval $[-3,2]$.

$f(x) = x^{\frac{2}{3}}(x+2)$

■ 2. Identify the critical point(s) of the function on the interval $[-2,2]$.

$g(x) = x\sqrt{4-x^2}$

■ 3. Identify the critical point(s) of the function on the interval $(0,4]$.

$h(x) = \dfrac{1}{x} + \ln x$

■ 4. Identify the critical point(s) of the function on the interval $[-3,3]$.

$f(x) = x^3 + x^2 - 8x + 5$

■ 5. Identify the critical point(s) of the function on the interval $[-1,3]$.

$g(x) = \sqrt{3+2x-x^2}$

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6. Identify the critical point(s) of the function on the interval $[-2,2]$.

$$h(x) = \frac{3}{2}(x^4 + 4x^3 - 9x^2 + 3)$$

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INCREASING AND DECREASING

■ 1. Determine the intervals where the function is increasing and decreasing.

$$f(x) = \frac{5}{4}x^4 - 10x^2$$

■ 2. Determine the intervals where the function is increasing and decreasing.

$$g(x) = -x^3 + 2x^2 + 2$$

■ 3. Determine the intervals where the function $h(x) = x^3 - 11x^2 + 39x - 4$ is increasing and decreasing.

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FIRST DERIVATIVE TEST

■ 1. Use the first derivative test to find the extrema of $f(x) = 4x^3 + 21x^2 + 36x - 5$.

■ 2. Use the first derivative test to find the extrema of $g(x) = 2x^3 - 14x^2 + 22x + 3$.

■ 3. Use the first derivative test to find the extrema of $h(x) = 2x^4 - 4x^2 + 3$.

■ 4. Use the first derivative test to find the extrema of $g(x) = 2x\sqrt{9 - x^2}$ on the interval $(-3,3)$.

■ 5. Use the first derivative test to find the extrema of $g(x) = -2x^3 + 6x^2 - 7$.

■ 6. Use the first derivative test to find the extrema of $h(x) = 3 + 10x^2 - 5x^3$.

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CONCAVITY

■ 1. For $f(x) = x^3 - 3x^2 + 5$, find inflection points and identify where the function is concave up and concave down.

■ 2. For $g(x) = -x^3 + 2x^2 + 3$, find inflection points and identify where the function is concave up and concave down.

■ 3. For $h(x) = x^4 + x^3 - 3x^2 + 2$, find inflection points and identify where the function is concave up and concave down.

■ 4. For $f(x) = (x + 6)^{\frac{2}{3}}$, find inflection points and identify where the function is concave up and concave down.

■ 5. For $g(x) = x^3 - 5x^2 + 7x - 3$, find inflection points and identify where the function is concave up and concave down.

■ 6. For $f(x) = -x^3 + 6x^2 - 9x + 2$, find inflection points and identify where the function is concave up and concave down.

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SECOND DERIVATIVE TEST

■ 1. Use the second derivative test to identify the extrema of $f(x) = x^3 - 12x - 2$ as maximum values or minimum values.

■ 2. Use the second derivative test to identify the extrema of $g(x) = -4x^3 + 12x^2 + 5$ as maximum values or minimum values.

■ 3. Use the second derivative test to identify the extrema of $h(x) = 2x^4 - 4x^2 + 1$ as maximum values or minimum values.

■ 4. Use the second derivative test to identify the extrema of $f(x) = 6x^3 - 8x^2 + 5$ as maximum values or minimum values.

■ 5. Use the second derivative test to identify the extrema of $g(x) = 3x^3 - 12x^2 + 12x + 7$ as maximum values or minimum values.

■ 6. Use the second derivative test to identify the extrema of $h(x) = 2x^3 - 6x + 11$ as maximum values or minimum values.

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